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ABSTRACT

A project organized by the Consortium for Mathematics and Science Education at the State University of New York at Albany is described. The purpose of the project was to develop closer linkages between practice and research in didactics in mathematics and science education. A state-wide research network was created of higher education faculty with research interests in mathematics and science education and clusters of pre-college faculty in the same disciplines interested in learning about or collaborating in research. This network would serve as a vehicle for identifying areas of research of concern to pre-college teachers, engaging teachers at all levels in collaborative efforts, facilitating research projects, and disseminating research results to classroom teachers. The rationale for the project, how the network was designed and formed, and the results of collaboration are discussed. Advantages and disadvantages or problems are listed, with suggestions for improving collaboration possibilities. Eleven references are included. (MNS)

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RESEARCH PRACTICE COLLABORATION

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The project described in this paper was organized by the Consortium for Mathematics and Science Education at the University at Albany, State University of New York, and supported by two professional associations -- the Association of Mathematics Teachers of New York State (AMTNYS) and the Science Teachers Association of New York State (STANYS). A major purpose of the project was to develop closer linkages between practice and research in didactics in mathematics education and science education. To achieve this purpose, we decided to create a state-wide Research Network of (1) higher education faculty in mathematics education and science education with research interests and (2) clusters of pre-college faculty in the same disciplines interested in learning about or collaborating in research. This broad-based network would, then, serve as a vehicle for identifying areas of research of concern to pre-college teachers, engaging teachers at all levels in collaborative efforts, facilitating research projects, and disseminating research results to classroom teachers.

Rationale The significance of collaborative research efforts was highlighted in the work of a theme group, convened by Dessart and Romberg at ICME 5 (Romberg, 1985). It is clear that even those research results that are directly related to mathematics education slowly, if ever, affect practice (Hogben, 1980). Some of the probable causes of this lack of implementation of research results include (1) ineffective dissemination efforts and (2) negative or, at best, neutral teacher perceptions of the usefulness of research. Farrell (Farrell & McDonald,1985), using a questionnaire adapted from Williams (1984) found teacher perceptions of the usefulness of research to be skewed toward the positive end of the scale. However, the population for this study was mathematics and science teachers in schools where a number of classroom studies had been conducted over a ten year period. The practice had been to communicate the results of these studies to department heads for dissemination to their staff. Responses to a questionnaire item dealing with the results of previous studies conducted in their schools showed that the teachers had little memory of the specifics of the research. Thus, it is doubtful that the results of the research were clearly communicated to the teacher-sample. As a result, there was likely to be little transfer of the research results into those classrooms.

The dissemination problem, with its concomitant problem of translating

research results into forms understandable to teachers, and specific enough to be implemented into the classroom, remains one of the most persistent obstacles to having research affect classroom practice (Howsom, Keitel, & Kilpatrick,1981). Howsom, Keitel and Kilpatrick (1981) considered this issue when describing the impact of large-scale curriculum development projects; they pointed to the importance of teacher involvement in various phases of the development for the curriculum project to succeed. These authors cited Great Britain as a country that has moved to a high degree of teacher involvement in curriculum development and, thus, to a high degree of teacher commitment. It is perhaps natural that reports of teacher involvement on research teams have come from Great Britain (Clegg, 1984), although there have also been reports of teacher involvement on research teams from France (IREM, 1984).

More recently, universities have used the concept of funded teacher research partnerships as a promising way to move research results into the classroom (Porter, 1987). Porter provided examples of the cost of, and barriers to, collaboration at the Institute for Research on Teaching, Michigan State University. Despite the possible limitations (e.g. teacher identification of problems created by particular school administrative policies, rather than those susceptible to improvement via research), Porter concluded that, in general, the teacher collaboration did strengthen the IRT's research agenda and did directly benefit practice (p. 149). In the IRT model, teachers were brought to campus on research fellowships. They studied research methodologies and worked on research teams.

A different model has been described by Gooding, Swift, McCroskery, Schell, and Swift (1988). In a year-long project at the State University of New York, College at Oswego, volunteer teachers in nearby schools selected an area of research from a specified list and were assisted in planning, interpreting, and analyzing the study. Data were collected in their home schools by the teachers, and staff from the College at Oswego served as support personnel. The support mechanism included planned large-group sessions and on-call visits to the school sites by faculty. Now nearing the end of the first year of the project, Gooding et al. reported highly favorable attitudes by the teacher participants, most of whom volunteered to continue in the project for a second year.

The Research Network Project

The Research Network project designed by the University at Albany faculty took into account a characteristic of higher education in New York State. There are a large number of small, private colleges in the state as well as

small, medium, and large public two-year colleges, colleges and university centers. In the smaller colleges, a mathematics or science educator is typically housed in a department of mathematics or one of the sciences in which basic research in the discipline itself is valued. Therefore, there are faculty who may not be active in research due to isolation from like-minded colleagues. These same faculty members spend considerable time working in pre-college classrooms and, thus, already have the teacher contacts so essential to the conduct of research in schools. It follows that they also have earned a measure of credibility and, thus, can be effective disseminators of research results. As a result, we deliberately designed a network that would include this untapped resource, rather than an exclusive, smaller network of existing, known researchers.

Secondly, we chose to design a network that would also cross the disciplines of mathematics and science education. Our own efforts over many years (See, for example, Farrell & Farmer, 1985 and Farrell & Farmer, 1988) and those of more recent Albany colleagues have focused on the interface of mathematics and science education in curriculum, instruction and research.

Formation of the higher education network In the fall of 1986, the network concept was presented to the executive boards of STANYS and AMTNYS who expressed enthusiastic support for the idea. These organizations provided their college member mailng lists and offered space in newsletters and journals to promulgate the network idea. In the spring of 1987, a letter and questionnaire to identify interested colleagues were sent to all on these mailing lists. Recipients were encouraged to share the materials with other interested colleagues. Potential advantages of such a network, cited in the letter, included (1) the pooling of thoughts and meager resources across and within disciplines, (2) sharing access to potential student data pools, and (3) interacting with colleagues in small, medium and large institutions.

By the end of May, 1987, with returns still being received, over 40 mathematics educators and 28 science educators had responded affirmatively and enthusiastically to the network; another smaller group expressed interest in being on the mailing list only. Returns from this total group showed that there was considerable interest in sharing information and ideas with colleagues and in exploring a variety of roles in research activities -- from offering their own students as a potential pool in a study, to involvement in writing a research proposal. A progress report was sent to all these colleagues in early June with an announcement of a research conference on the Albany campus on October 16, 1987. In August, a directory of all those in the network was distributed to all members. The October

conference included a combination of invited research presentations and small group meetings. The fifty participants responded enthusiastically to this first attempt to begin talking together about research issues of relevance to classroom practice. One immediate result was the formation of informal working groups, which began meeting at the subsequent annual meetings of STANYS and AMTNYS.

At these same annual meetings, Professors Margaret Farrell and Walter Farmer of the Albany faculty presented progress reports on the Network to the governing boards and membership of AMTNYS and STANYS, respectively. These sessions generated more interested participants at the collegiate level and an initial list of pre-college participants; they also generated a call for a second research conference. Given this continuing positive response, it was deemed desirable to create a state-wide Advisory Board. The Board, consisting of two collegiate faculty from mathematics education and two from science education, each from a different geographical area of the state, assumed direction of the Research Network in March, 1988. The new Board has now planned a second research conference to be held at Ithaca College, Ithaca, NY in October, 1988. The two state professional associations were asked to demonstrate their support for the Network by budgeting the sum of $500. each, as seed money for the next year of operation.

Formation of Pre-College Teacher Network Links

It seemed clear to us at the outset that the pre-college teacher's schedule would generally preclude participants from one area of the state working with participants in a distant area. Thus, the Network model was designed to include a series of links between pre-college mathematics and science teachers in a particular geographical region and the college faculty in that same region. The Albany faculty initiated the first formal link related to the Network in the Greater Capital District Area. An invitational symposium was held at the University at Albany in the spring of 1987. Invitees included mathematics and science teachers and department heads from the schools in the Greater Capital District. The invitees had either cooperated with us or our doctoral students in research, or expressed interest in research. Twenty-five participants attended the two hour symposium held on a weekday evening. The program included brief reports of current research efforts of our faculty and discussion groups on teachers' concerns relative to needed areas of research, ways to collaborate on a research project, dissemination efforts, and the like. The participants unanimously emphasized the need for more such symposia to provide one way for relevant research findings to be disseminated. They recommended that sessions of

this kind be a regular part of professional meetings of teachers. Finally, they provided a key to the kind of research reporting that is helpful to interested teachers. They directed us to include the conceptual background and emphasize **specific** ways classroom practice is related to the research findings, but de-emphasize the lengthy statistical parts of the research. Finally, the participants regretfully acknowledged that some of their colleagues are not, and probably would not become, interested in research or in change in their classrooms, regardless of the type of dissemination mechanism used.

As a result of the recommendations of this group of teachers, we organized research sessions for classroom teachers and asked that these be added to the programs of both AMTNYS and STANYS meetings in the fall of 1987. In addition, we organized a second research symposium for pre-college teachers at the University at Albany in the spring of 1988. Prior to this symposium, we invited several classroom teachers to form an ad hoc Advisory Group to assist us in planning the second spring symposium. On the basis of their recommendations, the research reports were lengthened, but kept informal and interactive. For example, one presentation was on the use of concept maps in a research study of sixth grade earth science instruction. The presenter introduced the study by distributing copies of a sheet with key concept-labels from the science unit in the study. The teachers were asked to form 2-3 person mathematics/science groups and draw a "concept map"--loosely described for them as a linking together of terms that they thought were related in some way. After approximately ten minutes of stimulated interaction in groups, the researcher showed typical maps by sixth graders before and after instruction, summarized problems and issues, and outlined the study. The participants' written feedback on this second symposium was replete with superlatives about the usefulness of the presentations and highly positive about the value of future research symposia of <u>this kind.</u> We are sharing these activities with colleagues in the Network and asking for other successful approaches to the formation of these Network links.

Teacher collaboration in research studies In the spring of 1988, I mailed a questionnaire to all members of the Network to gather information on the roles that classroom teachers have played in their recent research studies. There was a 29% return from the 96 members of the Network. Almost one-half of the respondents indicated that they had worked with teachers in recent research. The brief descriptions of the roles teachers played in research fell into 10 categories, arranged in order of least to most involvement as a research partner with college faculty.

Teacher Roles

1. Subjects of research --most often respondents in a survey
2. Designers, or co-designers with college faculty, of curricular materials
3. Supervisors of class while college researcher collected data
4. Collectors of data from own classes via paper-pencil tests
5. Interviewers of subjects (own students or other subjects), sometimes in conjunction with a task subject had to complete
6. Collectors/reducers of data, requiring special skills --e.g. translating material, analyzing curricular materials in terms of theoretical model
7. Co-partner in teaching experiment
8. Preparers of data for analysis by scoring or coding responses, and/or assisting in interpretaion of qualitative data
9. Developers (with college researcher) of instruments, interview scripts,...
10. Active partners in all phases of research study, from identification of problem to reporting of results.

The number of teachers involved in the roles noted above, ranged from 1 who worked as a co-partner in a teaching experiment, to 65 who administered, scored and assisted in the initial interpretation of paper-and-pencil test data, to 125 who were subjects in a survey. Included in the studies reported by members were action research projects, curriculum design or evaluation projects, and inservice development projects. Although some of the descriptions provided by respondents were not detailed, it is probably the case that some of these projects would not fall under the heading of a research study. However, since such involvement can serve as a first step to the ultimate objective of changing classroom practice in the light of the best available research, there was no attempt to screen out those responses.

One other role-category not listed above was that of teacher as researcher in a required research seminar. This category was excluded, not because it is unimportant, but because the involvement here is required and there is less unequivocal evidence for resultant change in the teacher's own classroom under these conditions. Yet, respondents who included this category were quite positive about the learning experience for the involved teachers and the potential for change. Other respondents, in identifying problems and solutions related to the involvement of teachers in research, identified the lack of teacher knowledge of research and research methodology as a problem and, in some cases, saw a required graduate research seminar as one way to address this problem.

Respondents were asked to identify advantages of research collaboration and disadvantages or problems. For those researchers who had involved teachers most directly, the advantages were crystal-clear.

Advantages

1. The collaborative effort assists the researcher to keep the study relevant and provides a fresh look at the problem.
2. If teachers collect data from their own students, they tend to believe the data and become more sensitive to other relevant research results.
3. Teacher involvement of more than an administrative nature leads to ownership and is more likely to lead to change in the classroom.
4. Teacher-researchers involved actively in the study allow the collection of more data, across more parameters.

Disadvantages or problems

1. **There needs to be more time available.**
2. Teachers need to be trained, not only in methodology, and design, but in the need to remain impartial while collecting data.
3. Attitudes of teachers towards research, of researchers toward teacher involvement and of school administrators toward teacher involvement -- all need to be examined and changed, as needed, to ones of mutual respect and support.

Notice the first problem cited. Repeatedly, from successful collaborators and those who have not reported such collaboration, the constraints of time were noted. The time constraint was felt to be a problem, both for the college faculty researcher and the pre-college faculty researcher. As might be expected, when the respondents provided suggestions, the time constraint was addressed often. However, even more frequently, the issue of the need to give teachers ownership of the project was addressed. Some of the more common suggestions are listed next.

Suggestions for improving collaboration possibilities

1. Support pre-college teachers by obtaining released time funding, by seeking more flexible scheduling at the district level
2. Earmark grant money for equipment or classroom materials for those teachers who wish to collaborate on projects
3. Initiate research sessions at local meetings
4. Initiate research seminars in graduate programs; structure these so that groups of students can explore research areas together
5. Involve teachers gradually in their areas of expertise, e.g. writing progress reports; collecting data
6. Have informal research seminars in which research in progress is discussed and questions of implications or direction of analysis are considered

7. Even when teachers are subjects of research, invite small groups to meet and discuss and offer interpretations of data/ results **before** final analysis and reports are completed.
8. Give teachers who do collaborate in research a sense of ownership by involving them in as many phases of the study as possible. In particular, include teachers as colleagues in presentations and invite them to co-author papers.

In all of the suggestions above, there was an underlying assumption that was voiced by one respondent. Start with a small group of interested teachers. If the project is meaningful to them and they are indeed participating in a cooperative way, they will spread the word to other colleagues.

Conclusion

The Research Network project reported on in this paper has already enjoyed success, as a mechanism for bringing together colleagues to listen to and talk about research related to classroom practice. We are encouraged by this success. There is clearly a need for state or perhaps, regional, networks that themselves will become links between the practitioners and the relatively small group of nationally known researchers.

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